PYTHON FOR COMPUTATIONAL PROBLEM SOLVING

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Control Structures

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What is a Control Structure?

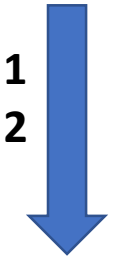
Control flow is the order that instructions are executed in a program. A **control statement** is a statement that determines control flow of a set of instructions.

There are three fundamental forms of control that programming languages provide,

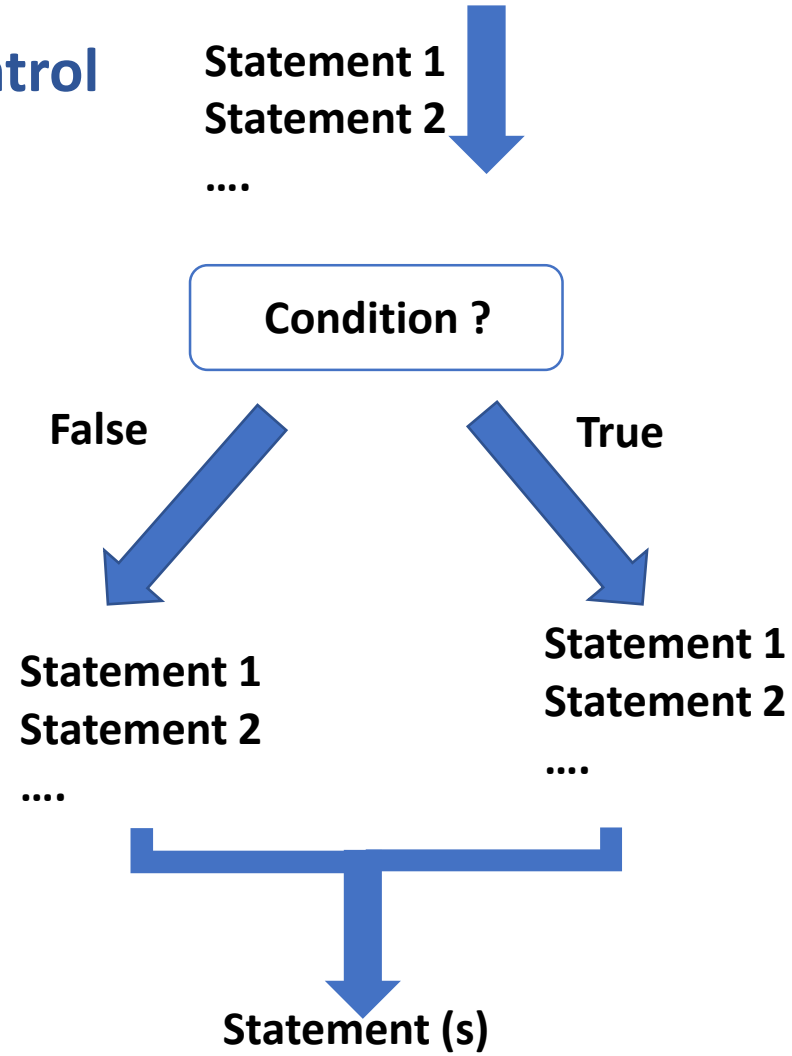
- **sequential control**
- **selection control**
- **iterative control**

Sequential Control

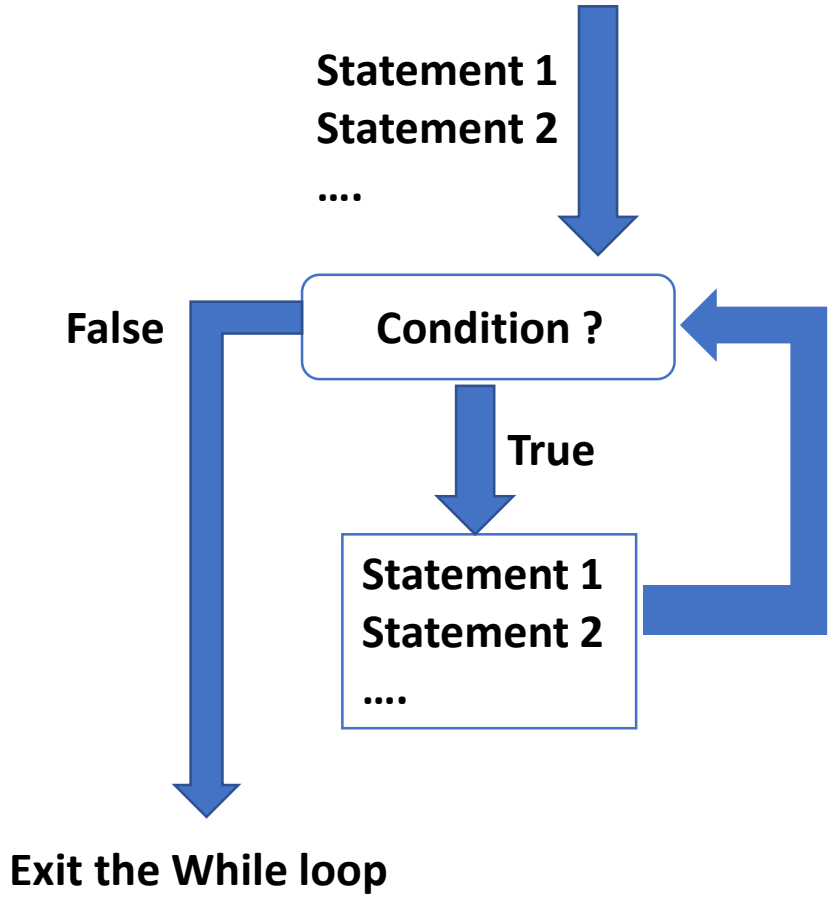
Statement 1
Statement 2
....



Selection Control



Iterative Control



Selection Control : If Statement

An if statement is a selection control statement based on the value of a given Boolean expression.

if statement	Example use	

`if condition:`
`  statements`
`else:`
`  statements`
	`if grade >= 70:`
	`  print('passing grade')`
	`else:`
	`  print('failing grade')`
		`if grade == 100:`
		`  print('perfect score!')`

Note that if statements may omit the “else” part.

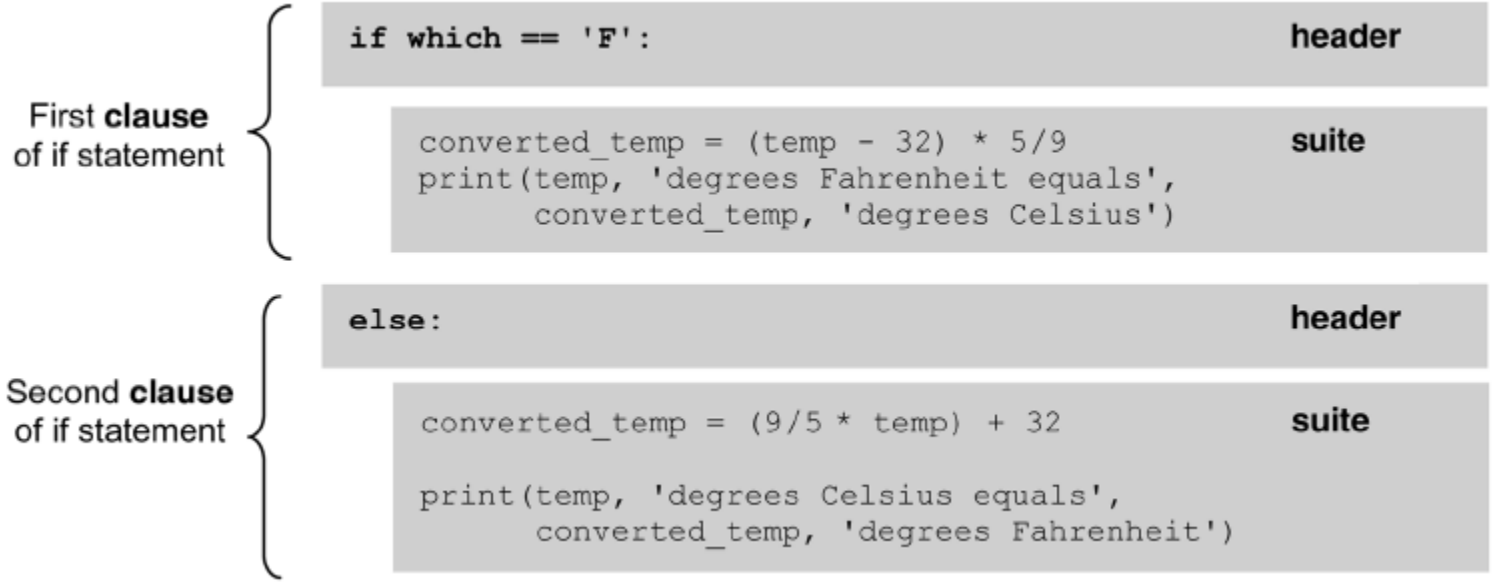
Indentation in Python

One fairly unique aspect of Python is that the amount of indentation of each program line is significant.

In most programming languages, indentation has no affect on program logic—it is simply used to align program lines to aid readability.

In Python, however, indentation is used to associate and group statements.

Control Structures



A **header** in Python is a specific keyword followed by a colon. In the example, the if-else statement contains two headers, "if which 5 = 'F':" containing keyword if, and "else:" consisting only of the keyword else. Headers that are part of the same compound statement must be indented the same amount—otherwise, a syntax error will result.

Control Structures

The set of statements following a header in Python is called a **suite** (commonly called a **block**). The statements of a given suite must all be indented the same amount. A header and its associated suite are together referred to as a **clause**.

A **compound statement** in Python may consist of one or more clauses. While four spaces is commonly used for each level of indentation, any number of spaces may be used, as shown below.

Valid indentation		Invalid indentation	

(a)
`if condition:`
`  statement`
`  statement`
`else:`
`  statement`
`  statement`
	(b)
	`if condition:`
	`  statement`
	`  statement`
	`else:`
	`  statement`
	`  statement`
		(c)
		`if condition:`
		`  statement`
		`  statement`
		`else:`
		`  statement`
		`  statement`
			(d)
			`if condition:`
			`  statement`
			`  statement`
			`else:`
			`  statement`
			`  statement`

Multi-Way Selection

Python provides two means of constructing multi-way selection—one involving multiple nested if statements, and the other involving a single if statement and the use of **elif** headers.

Nested if statements

```
if condition:
    statements
else:
    if condition:
        statements
    else:
        if condition:
            statements

            etc.
```

Example use

```
if grade >= 90:
    print('Grade of A')
else:
    if grade >= 80:
        print('Grade of B')
    else:
        if grade >= 70:
            print('Grade of C')
        else:
            if grade >= 60:
                print('Grade of D')
            else:
                print('Grade of F')
```

Iterative Control

An **iterative control statement** is a control statement providing the repeated execution of a set of instructions.

An *iterative control structure* is a set of instructions and the iterative control statement(s) controlling their execution.

Because of their repeated execution, iterative control structures are commonly referred to as “loops.”

We look at one specific iterative control statement : **the while statement.**

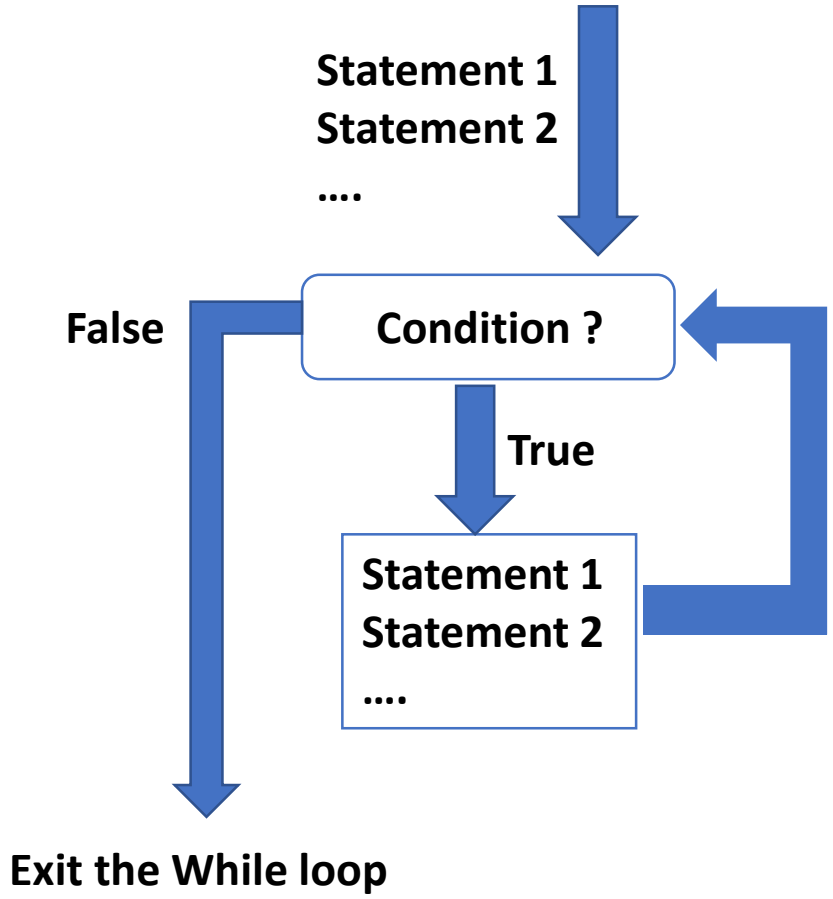
While Statement

A **while statement** is an iterative control statement that repeatedly executes a set of statements based on a provided Boolean expression (condition).

There are 3 ingredients to any iterative statement:

1. Initial value of the iterative counter
2. Iterative condition
3. Updating the iterative counter

Iterative Control



Control Structures

As long as the condition of a while statement is true, the statements within the loop are (re)executed

Once the condition becomes false, the iteration terminates and control continues with the first statement after the while loop

If the condition may be false the first time a loop is reached, the, and therefore the loop would never be executed.

Syntax:

while ***condition:***
    suite

Example:

```
counter= 1
sum = 0
while count <= n:
        sum= sum+ counter
        counter = counter + 1
```

Infinite Loops

An **infinite loop** is an iterative control structure that never terminates (or eventually terminates with a system error).

Infinite loops are generally the result of programming errors.

For example, if the condition of a while loop can never be false, an infinite loop will result when executed.

THANK YOU

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